Supporting Information

Hybrid Integrated PDMS Microfluidics with Silica Capillary

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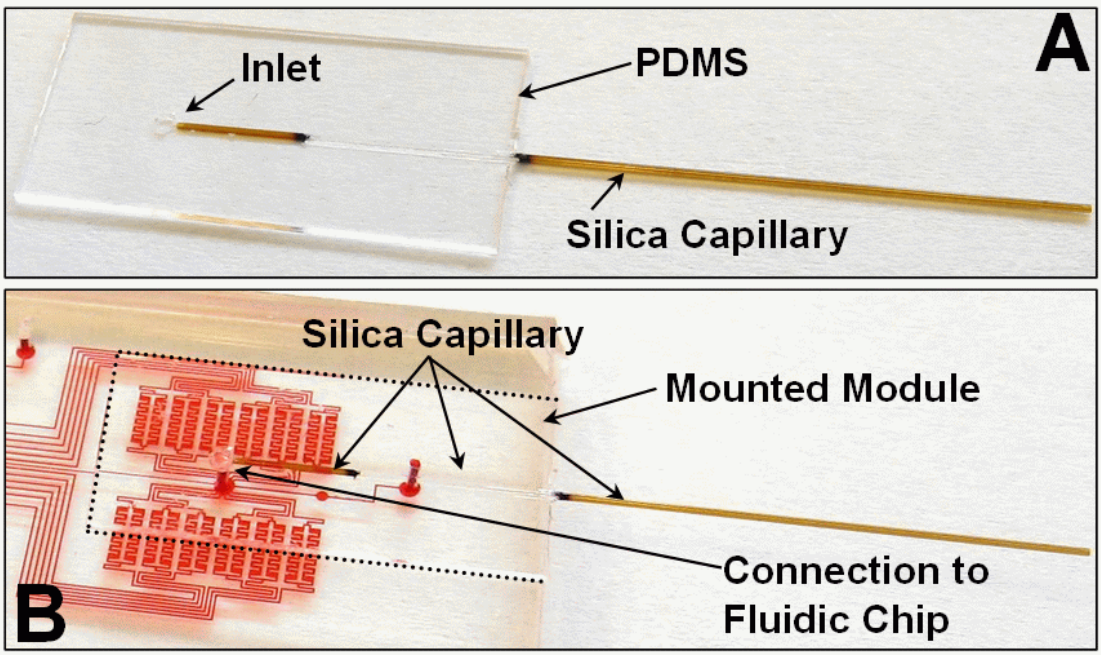

Support Figure 1. (A) iPSC module with capillary extending beyond the PDMS. (B) The module is mounted onto a PDMS microfluidic chip and the silica capillary extends beyond the chip footprint allowing for coupling to electrical contactless or UV detectors. Furthermore the extended capillary has the potential of being easily coupled to ESI-MS with zero dead volume.

Fabrication

In brief the fabrication process of the microfluidic chip includes a mould created using negative photoresist SU8-2100 (Microchem, Newton, MA, USA). The SU8-2100 is deposited on a clean silicon wafer using a spin coater (P6700 Specially Coating Systems, Indianapolis, IN, USA). The resist is spread onto the wafer at 500 rpm for 10 s and then ramped up to 2500 rpm at an acceleration of 300 RPM/s. Once 2500 rpm is reached, the substrate is spun for 30 s to form an 80-micron layer. The wafer is then soft baked at 65 ºC for 5 min and at 95 ºC for 30 min. After soft baking, the wafer is exposed for 10 s at 9.5 mW/cm^2 using a Karl-Süss KSM MJB-55W (Garching, Germany) mask aligner. The wafer is post exposure baked for 5 min at 65 ºC and 12 min at 95 ºC. The wafer is then allowed to cool to room temperature and then developed in Microposit EC Solvent (Chestech, Warwickshire, UK) developer for 4 min. PDMS was prepared according to the manufacturer's instructions, degassed in a vacuum chamber for 30 min, poured onto the mould and cured in a 60 ºC oven for 4 hrs. The PDMS was then carefully peeled off the mould. The fluid inlets and outlets were punched with a 1-mm OD flat-tip needle. For sealing the channels a 25 mm × 70mm (VWR International Inc., USA) glass cover slide together with the PDMS structures were treated with ozone for 10 min and bonded for 10 hours at 90 ºC.

In cases where access to microfabrication facilities is limited several fast, simple and economical techniques such as μPLAT[1], Shrinky-Dink micro-structuring[2] or wax printer generated microfluidics[3] may be applied.

The fabrication of the iPSC module takes around 7 min. to complete. This duration includes 10-second spin-coating PDMS pre-polymer, 30-second loading the capillary with water and letting it submerge into the PDMS, 5-minute curing of PDMS, and 1 minute for cutting and inlet punching. It does not take into account the fabrication time of the microfluidic chip.

Operation and Use of the iPSC Module

Priming and flowing aqueous solutions through the iPSC module is relatively simple because the silica surface of the capillary is hydrophilic, so bubble free priming is simply achieved by placing an aqueous droplet in the inlet port of the iPSC module. Also continuous pressure driven flow through the capillary is easily generated by applying negative pressure at the waste port of the iPSC module and a droplet at the inlet port. During the pressure driven flow no air enters the capillary because, the waste port is not fluidically connected to microfluidic chip and the droplet at the inlet port maintains a constant input of buffer supply.

The plug-and-play iPSC module has to be mounted onto the fluidic chip. The successful mounting of the iPSC module only requires that the iPSC inlet port has to intersect with the sample outlet port of the microfluidic chip so as to establish a fluidic connection. Generally the iPSC inlet port and the sample outlet port have a diameter range of 0.4 – 1 mm thus alignment during mounting is easily achieved without the need for any special alignment equipment or techniques. Furthermore due to the reversible bonding any aligment mistakes can be easliy corrected by just lifting off the iPSC module, realigning it and mounting it onto the fluidic chip. If required a small layer of 80% ethanol can be used between the iPSC module and the microfluidic chip to temporarily suspend the PDMS reversible bonding and allow a more precise alignment.

In case the fluidic chip has to be replaced several times, handling can be facilitated by increasing the thickness of the iPSC module.

Materials Used

N-Tris(hydroxymethyl)methyl-3-aminopropanesulfonic acid (TAPS), Triethylamine, Sodium fluorescein (FL), 2, 7-Dichlorofluorescein (DCF), Sodium hydroxide, Sodium chloride, and Tris-borate-EDTA buffer were purchased from Sigma-Aldrich (St. Louis, MO, USA). Sylgard 184 Polydimethylsiloxane was obtained from Dow corning (Midland, MI, USA). All chemicals were analytical grade or better and used as received without further purification. Fused silica capillaries were obtained from Polymicro Technologies (Phoenix, AZ, USA). A sample of Green Fluorescent Protein (GFP) in PBS was prepared in house through genetic recombination using *E. Coli*. All solutions were prepared with deionized water that was processed with a Barnstead® NANOpure Dlamond™ ultra high purity water system.

References

1. S.-H. Chao, R. Carlson and D. R. Meldrum, *Lab on a Chip*, 2007, **7**, 641-643.
2. A. Grimes, D. N. Breslauer, M. Long, J. Pegan, L. P. Lee and M. Khine, *Lab on a Chip*, 2008, **8**, 170-172.
3. G. V. Kaigala, S. Ho, R. Penterman and C. J. Backhouse, *Lab on a Chip*, 2007, **7**, 384-387.